Douglas-fir Dwarf Mistletoe: Concerns and Controversy in Management

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Introduction

Objectives for management of Federal forest land has evolved from producing primary sawlog value, to fiber production, the enhancement of wildlife habitat, to forest health and associated ecosystem management and restoration. Changes in the law and its interpretation, and agency policy increasingly drive management direction. Questions and concerns regarding appropriate desired future condition of vegetation and the pathways to achieve those objectives abound. Similarly, these controversies also surround appropriate management and need for treatment of insects and diseases. Since native insects and diseases are natural components of our ecosystems, the question is frequently asked why they need to be viewed as pests and managed as such. This paper specifically looks at management-related concerns specific to Douglas-fir dwarf mistletoe and in reference to the Big Lookout Mountain Area BLM Geographic Unit (GU) and the Draft EIS. Management of Douglas-fir infected with Dwarf mistletoe in northeastern Oregon is thoroughly covered by Schmitt (1997).

Fire

Historically, wildfires have been the most important factor governing the distribution and abundance of dwarf mistletoe (Alexander and Hawksworth 1975; Wicker and Leaphart 1974). Wildfires are effective in limiting dwarf mistletoe populations because trees regenerate to burned sites faster than the mistletoe returns (Hawksworth and Wiens 1996). Although in cases where mistletoe-infected thick-barked fire survivors such as Douglas-fir inhabit sites where fir also is a substantial pioneer species, infection can rapidly spread from remnant old fire survivors to nearby newly regenerated firs following most fire disturbances. Historic fire cycles in the Big Lookout Mountain area probably favored a moderately higher proportion of larch in the older overstory structure and undoubtedly a much lower Douglas-fir component in the understory. Current Douglas-fir age structure are mostly trees less than 100 to 150 years old, with the youngest stands in the southern portion of the area. In the southern third of the area there were very restricted pockets of older trees, probably refugia from the last major fire(s). If indeed large fires were the genesis for the bulk of the 150 year old and younger age classes, dwarf mistletoe likely spread from scattered fire survivors, most of which are no longer in existence. There is evidence that Douglas-fir has expanded its range and coverage in recent decades, moving into what had been mountain shrub communities, probably maintained mostly in shrublands by fire. Large continuous young fir stands without any dwarf mistletoe on the south-end are suspect invasive stands, since lack of this parasite over large areas in the otherwise heavily-infected Big Lookout Mountain area can mean either a large conflagration without fir survivors had occurred about a 120 years ago, or few fir had existed in this portion of the area in the recent past.

Stand age is higher in the northern-half of the GU and severity of mistletoe infestation is highest. While fir has long been a permanent feature in these stands, stand structure is believed to have changed and as a result, mistletoe is believed to have spread and intensified beyond historic levels. This conclusion is drawn from changes in stand structure that have occurred since the exclusion of fire. Lack of sanitation effects of fire to both understory trees, low-hanging brooms, and broomed trees in the overstory, and most importantly, the heavy understory and mixed layer structure that is most conducive for spread and intensification of dwarf mistletoe.

Other Big Lookout Mountain stands appear to have changed regarding the proportion of fir stocking as well. Large aspen communities are extensive throughout the Big Lookout Mountain area, and there is evidence that Douglas-fir has been expanding into aspen sites in over the last century. Shaded-out dead and declining aspen overtopped by relatively young fir suggest changes in vegetation that have occurred since the suppression of ground fire.

In general, there probably is a strong correlation between the severity of current dwarf mistletoe and the

historic distribution of Douglas-fir. To clarify, severe dwarf mistletoe almost invarably indicates a historic fir community, although lack of mistletoe can mean numerous factors *including* the absence of historical fir stocking.

Several prescribed fire studies have been done to determine the effects on reducing dwarf mistletoe intensity levels, and to test if management objectives of reducing dwarf mistletoe levels can be achieved. Although published evaluations of prescribed fire and effects on Douglas-fire dwarf mistletoe are lacking, the effects of burning and dwarf mistletoe in ponderosa pine and lodgepole pine, which has been studied, and Douglas-fir, are probably similar.

Working with western dwarf mistletoe (*Arceuthobium campylopodum*)-infected ponderosa pine, Koonce and Roth (1980) found that dwarf mistletoe can be partially sanitized in thinned and unthinned stands by prescribed underburning. Generally, more severely-infected trees are likely to be killed in light fires, mostly due to the inflammability of broomed lower branches. Additionally, trees that are not killed may have lower broomed branches burned or removed by fire. Similar findings have been found in lodgepole pine (Zimmerman and others 1990) where prescribed burning removed a higher proportion of the more severely mistletoe-infected trees. Harrington and Hawksworth (1990) found that the amount of fire scorch was the primary factor in first-year mortality in ponderosa pine, and the amount of mortality associated with higher levels of scorch was positively associated with degree of dwarf mistletoe infestation.

Zimmerman and Laven (1984) found in mistletoe-infected lodgepole pine that dwarf mistletoe abundance was inversely proportional to fire frequencies.

Historical natural processes

Frequent fires spaced trees out and reduced mixed canopy structure that quickly develops in the absence of fire in nearly all Inland Empire conifer forested communities. Mixed age structure is highly conducive to mistletoe spread as seeds produced high in the canopy rain down on small trees in the understory. Without sanitation effects of fire, these heavily infected smaller trees eventually replace the overstory trees. Douglas-fir branch brooming does not fully develop until trees get plenty of light, and the level of brooming is proportional to the impact on vigor.

We can infer that managed prescribed burning probably emulates the conditions that prevailed under a historic (natural) regime of frequent light fires and occasional stand replacement fire. While no specific data is available to make comparisons between current dwarf mistletoe levels, and those range of levels that existed prior to the mid 1800's, it is believed by forest ecologists that the historic fire regime was the primary factor in defining stand species composition, age and size structure, and spacing (Johnson 1998; Heyerdahl and Agee 1996). The vegetation attributes maintained by frequent burning are clearly restrictive to Douglas-fir dwarf mistletoe. While mistletoe was certainly a plant community component, The range of occurrence in terms of incidence and degree of infection on hosts was undoubtedly less than what currently occurs. While fire can be assumed to have reduced the Douglas-fir dwarf mistletoe host component, as well as modifying stand structure to retard mistletoe spread, there is also the direct effect of fire on mistletoe-infected trees.

A frequent question asked regarding dwarf mistletoe is why does a natural ecosystem component, such as dwarf mistletoe, need to be actively managed if objectives are ecosystem management rather than fiber production (Tinnin and others 1999). Several points can be addressed regarding the need to sometimes actively suppress mistletoe:

- Insect and disease affects can be maintained at "endemic" levels to assure that beneficial effects, such as wildlife habitat, is provided. Excessive effects, or "impacts", probably defined in terms of growth losses, mortality, and predisposition to fire, considers that sustainable production of resource goods and services is a legitimate expectation of Federal lands. Defining the line between allowable *endemic insect and disease activity* and *pest impacts* is usually subjective.

- Natural historic disturbance regimes, usually fire, had a profound effect on

vegetation composition, structure and related insect and disease activity. Recent deviation from historical condition as a result of fire suppression and seral species selection harvesting is generally perceived as being the principle factor in the increases of many disease and insect pests and their associated activity. Disturbance-dependent and deprived forested communities, usually termed as being outside of the historic range of variability (HRV), warrant active management or restoration by some as being beneficial to forest health.

- Use of prescribed ground fire, in an attempt to reintroduce periodic fire disturbance, would achieve most of the goals of restoration of HRV in terms of structure and composition of vegetation, but will also reduce some insect and disease activity, including incidence and severity of Douglas-fir dwarf mistletoe.

- Native insect and diseases usually act within a range of population density and activity that is related to some identifiable as well as unknown factors. The level of historic activity is sometimes known, e.g., the periodicity of defoliator outbreaks determined by dendrocronology of long-lived survivors. Other insect and disease activity is less suitable for direct estimates of historic occurrence. However, approximations can be made relative to current activity in stand types of structure and composition similar to the range of what existed prior to the mid 1850's. Current age and distribution of trees and stumps can provide enough clues to allow good reconstruction of historic conifer vegetation conditions in most plant communities.

- Douglas-fir dwarf mistletoe will impact objectives and management direction that include the development of large tree structure. While large dwarf mistletoe-infected trees are common, these trees probably became infected when older and developed under substantially different conditions then what will occur in the future. Trees that become infected when young and develop brooming often die or become stunted.

Management options and appropriate silviculture strategies related to reducing dwarf mistletoe incidence and related impacts can be designed to protect perceived old-growth stand structure. Recommendations provided in technical assistance reports (Schmitt 1997, 2000) can be followed, perhaps with some modification where overstory trees need to be retained.

- Retention of large stand structure will include keeping most or all of the largest trees in the treatment area. If large overstory trees are prevalent, some overstory removals can probably be done without adversely affecting old growth esthetics. Trees that are removed should be done with sanitation of mistletoe a primary selection factor.

- Depending upon the density of the overstory and the plant community type, understory vegetation should receive primary management attention. This could involve near complete removal if "park-like" conditions were desired. Understory species could be manipulated in either thinning of residual understory or managing for future regeneration. In either scenario, non-hosts to *A. douglasii* should be used. Larch and aspen are most viable in this area.

- Use of prescribed burning would achieve most of the same objectives as mechanical thinning from below.

- Pruning of lower broomed limbs can be effective in reducing impacts on vigor to infected trees, as well as reducing spread potential to nearby and understory hosts (Hadfield 1999).

Summary

Silviculture in Inland Empire fire-dependent conifer forests invariably addresses objectives of reducing the impacts or risks to future insect and disease activity. Management direction and objectives have become ever-increasingly controversial, with often unclear and contradictory direction, policy and law given to federal land managers. Direction and strategy and implementation is frequently the result of compromise and often the selected treatment or even inaction is not the venue that is most biologically sound. Use of historical pre-fire suppression conditions as a baseline for desired future condition is currently accepted by many. Given that the range of historic conditions are largely healthy functioning systems, the roles of insects and diseases, considered in terms of incidence and virulence, can be accepted and encouraged when functioning in that range, but warrant suppression tactics at higher than these levels. Most forested vegetation has changed in the last 150 years due to past management practices and exclusion of fire. Most insects and diseases, including Douglas-fir dwarf mistletoe, have expanded outside of their HRV along with their hosts, and suppression can usually be easily justified to improve forest health.

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